



Satellite Products Inter-Comparison Using the NOAA Products Validation System (NPROVS) and Plans for NPP Cal/Val

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Acknowledgements Murty Divikarla (IMSG), Nick Nalli (IMSG), Chris Barnet (STAR) ...
(funding under JPSS/NPP cal/val program)

**18th Conference on Satellite Meteorology
Oceanography and Climate
New Orleans, January 22-26, 2012**



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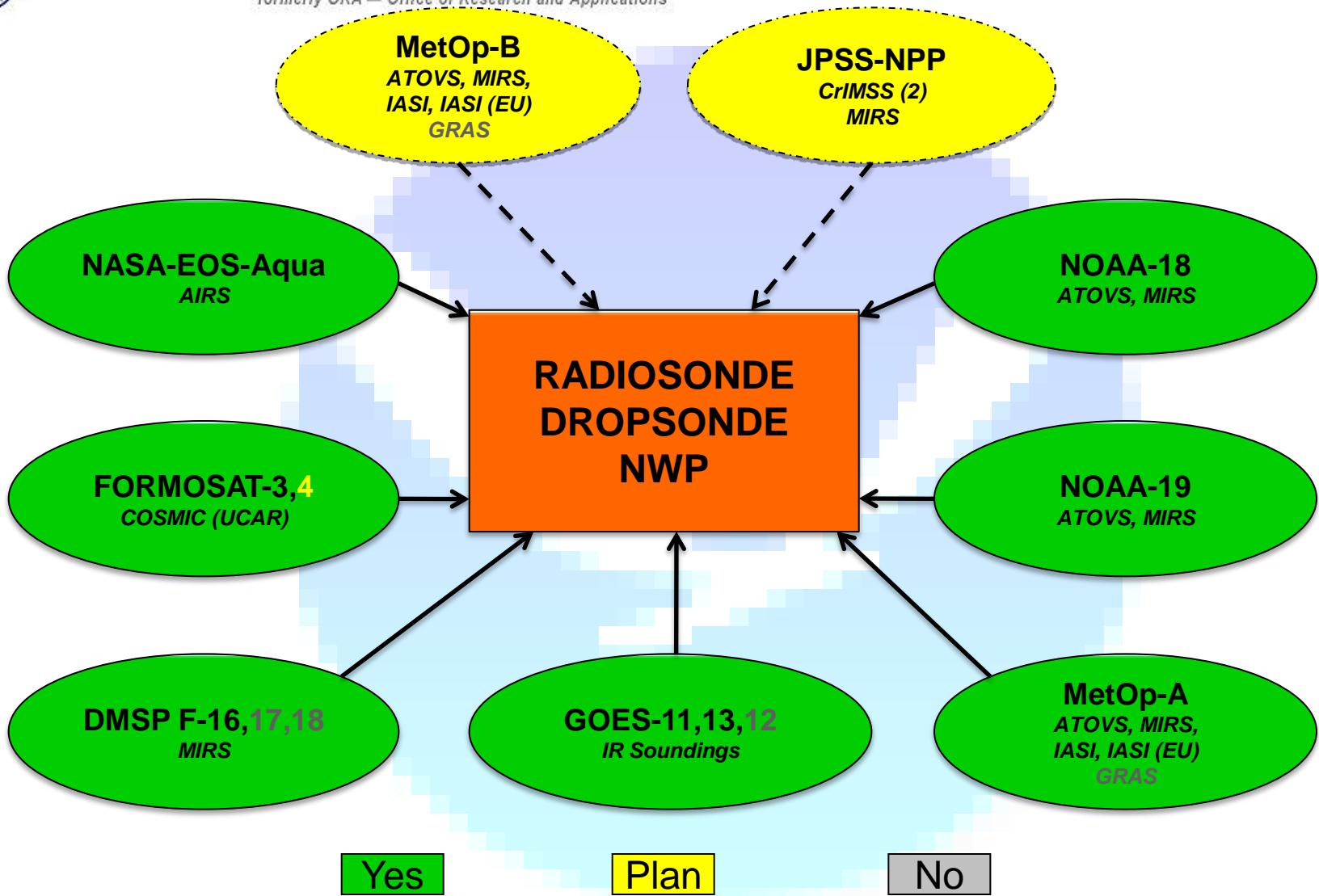
Outline

- What is NPROVS
 - What's new
- IASI vs ATOVS vs GFS vs Sonde Profiles
 - QC
 - Terrain
 - Cloud
- Bringing in NPP
 - IDPS (NGAS), NUCAPS (NOAA), MiRS
 - Revised guidelines for validation
 - Meeting spec
- GCOS Reference Upper Air Network (GRUAN)
 - Site Atmospheric State Best Estimate (SASBE)
 - *at NPP overpass ?*



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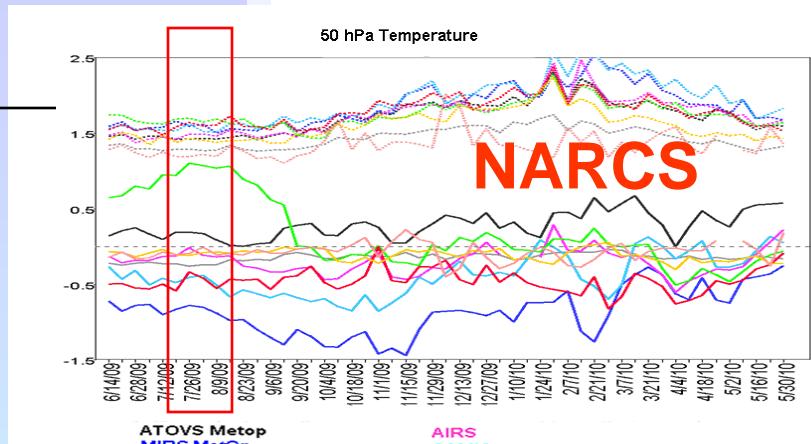
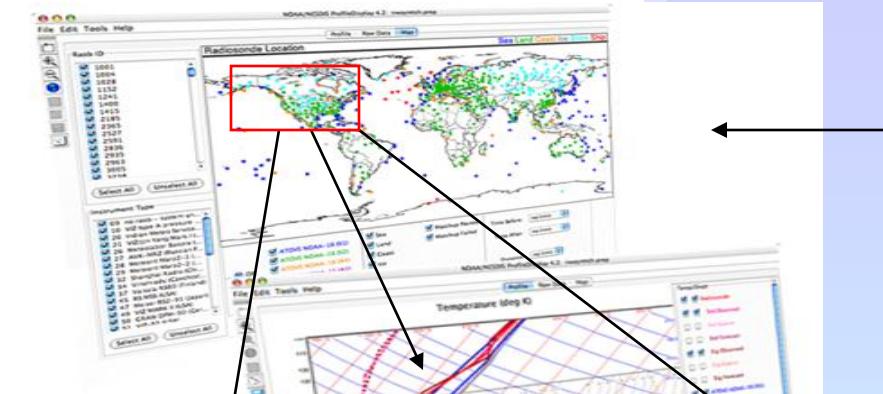
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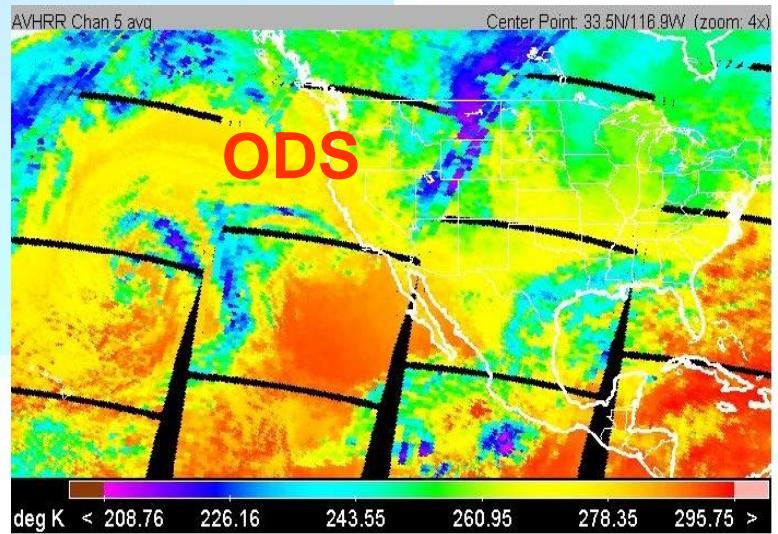
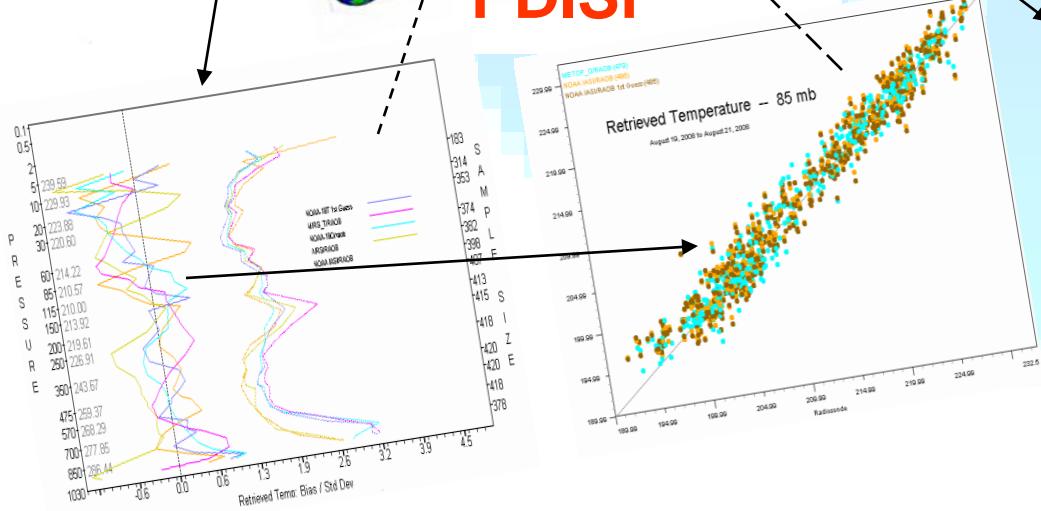
NOAA Products Validation System (NPROVS) Schematic



NPROVS- Environmental Data Graphical Evaluation (EDGE) Analytical Interface



PDISP





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NPROVS Web Site

- Pre-computed monthly ***performance*** statistics for selected product combinations
- Pre-computed ***performance*** trends since April 2008
- Download PDISP and NARCS graphical display applets and datasets

<http://www.star.nesdis.noaa.gov/smcd/opdb/poes/NPROVS.php>



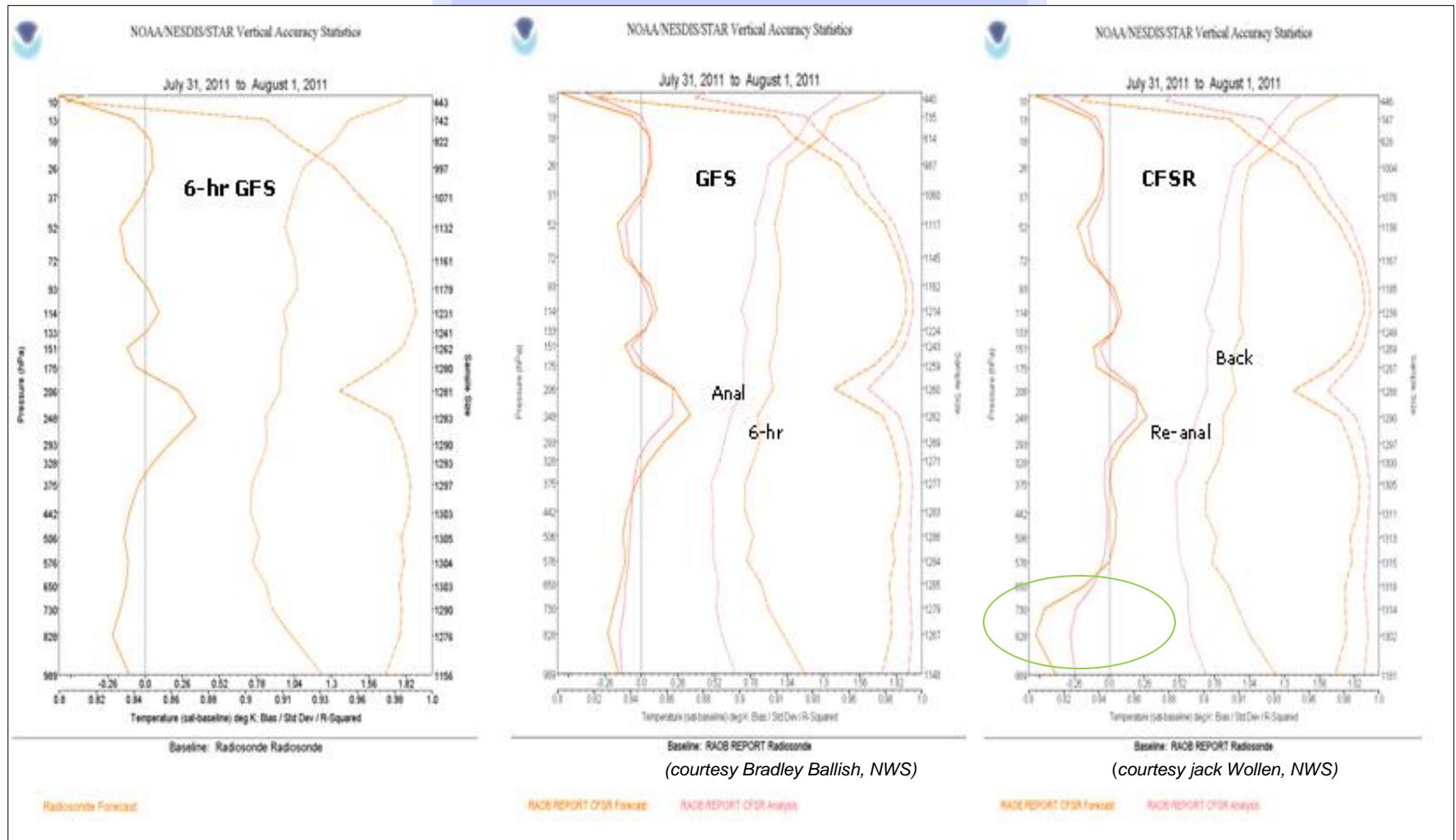
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What's New !

GFS and CFSR Analysis and Background interpolated to sonde

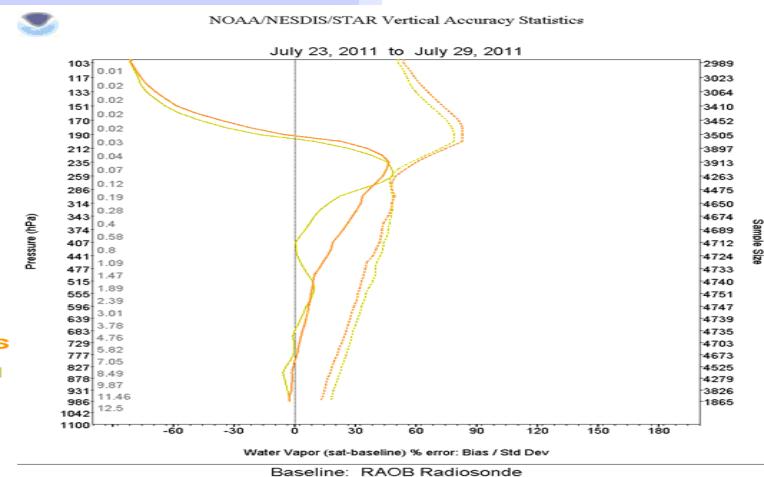
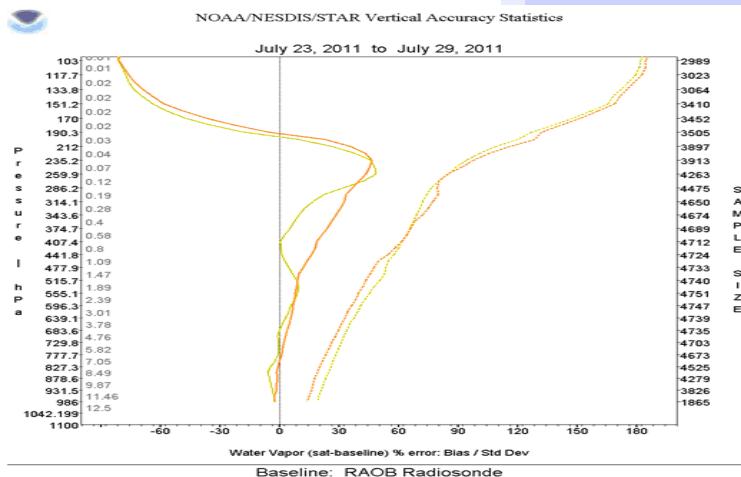


... vertical profiles of Mean, St. Dev from Sonde and “ R^2 ”

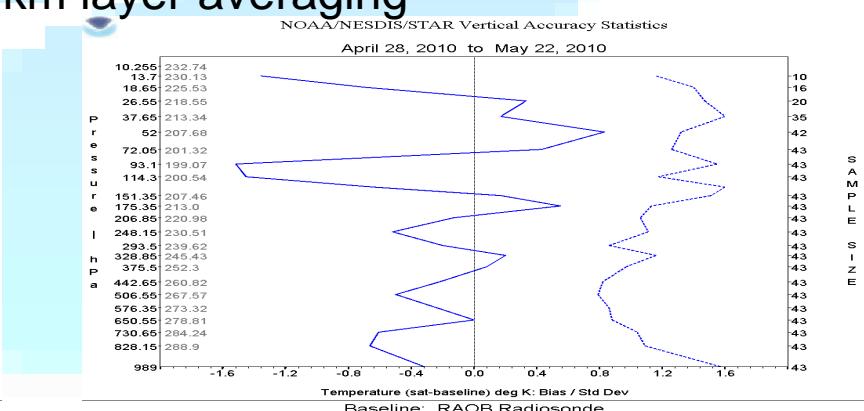
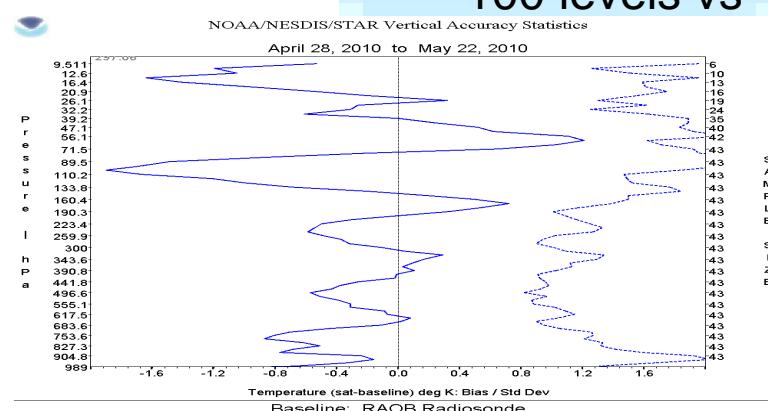


What's New !

Weighting the moisture % differences...



100 levels vs 1km layer averaging



IASI NOAA

IASI NOAA

... vertical profiles of differences from Sonde



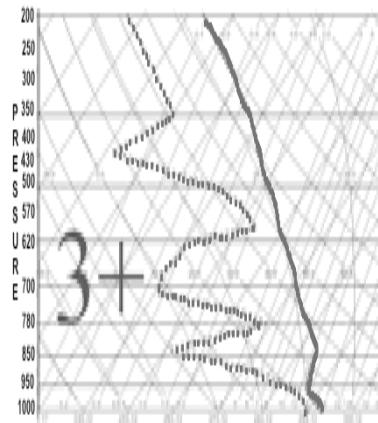
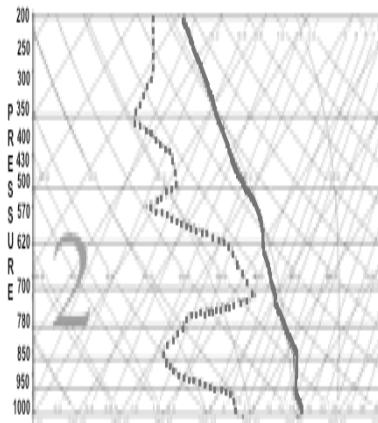
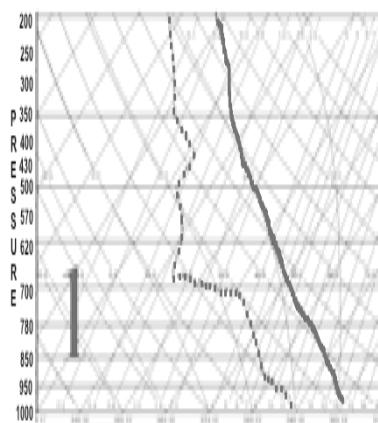
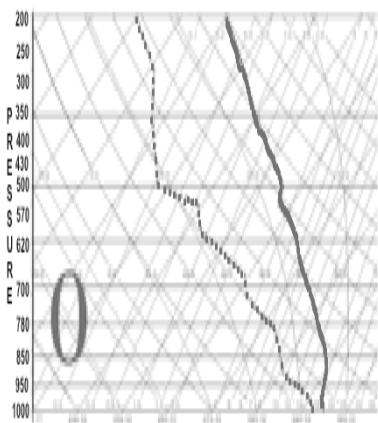
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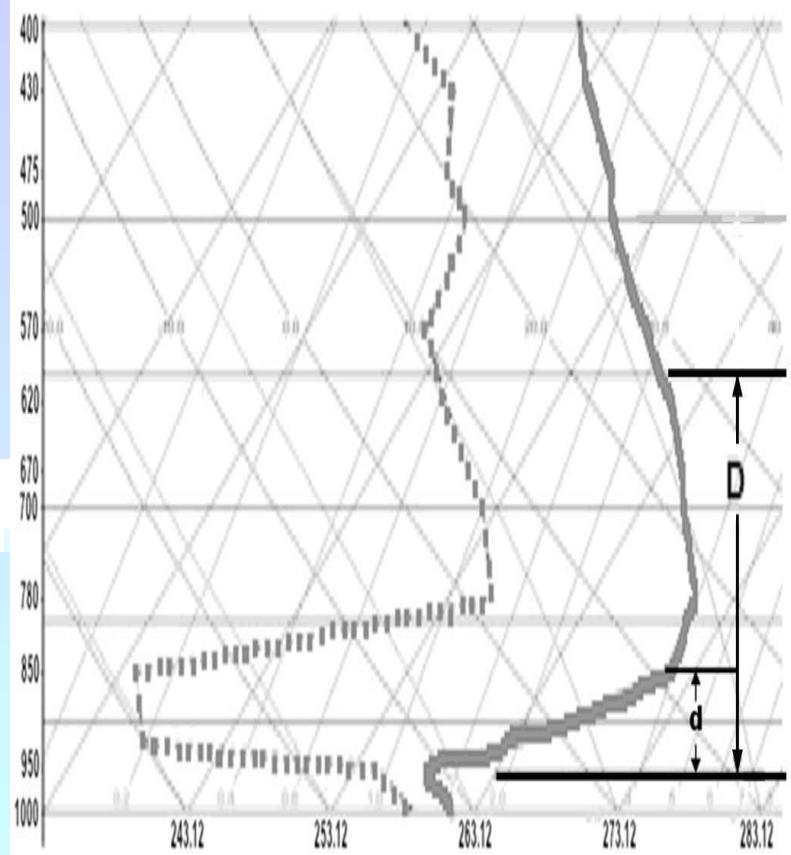


What's New !

Radiosonde Profile Characterizations



Moisture Structure



Temperature Inversions



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Radiosonde Profile Characterization Parameters

- *Terrain (land, coast, ship, island)*
- *Cloud*
- *Day/nite*
- *Superadiabatic*
- *Moisture profile shape*
- *TPW Increment*
- *UT / LS ... suspicious moisture*
- *T inversions (surface, aloft)*
- *Rad Correction (site, NCEP)*
- *Instrument type*

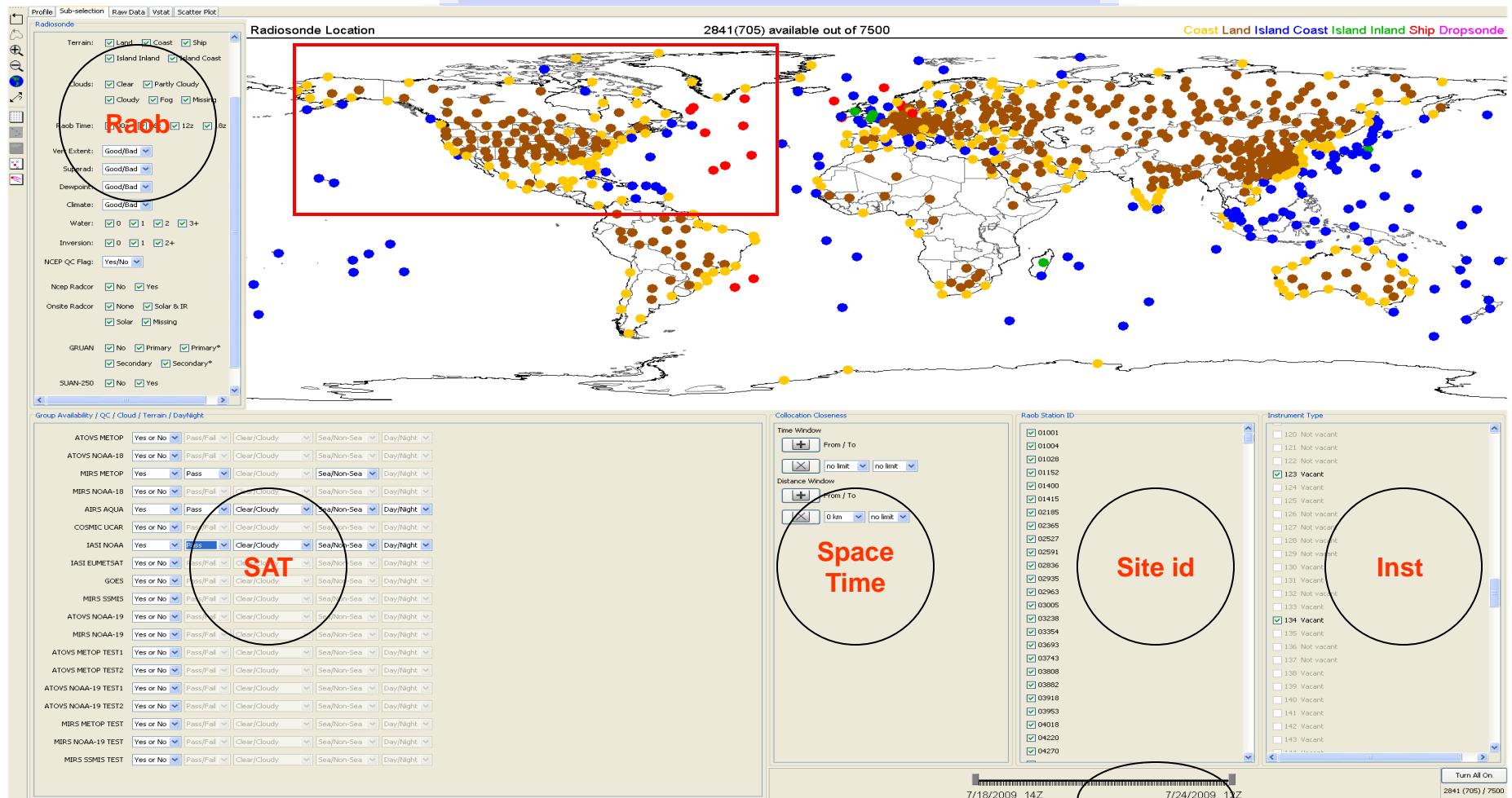
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NOAA Products Validation System (NPROVS)

PDISP user interface for display and analysis of collocated data



... 7500 radiosondes over 7 days



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IASI vs ATOVS vs GFS vs Sonde

QC, Terrain, Cloud

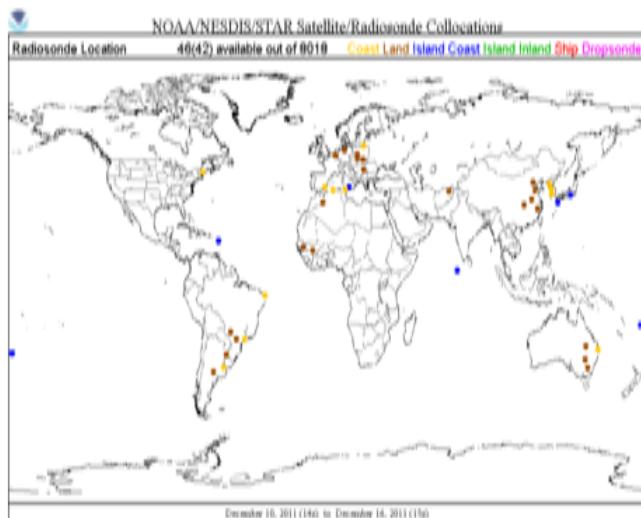
Yield !



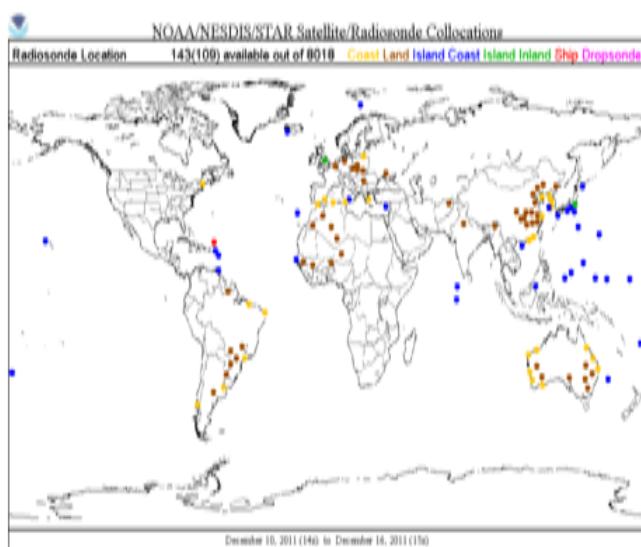
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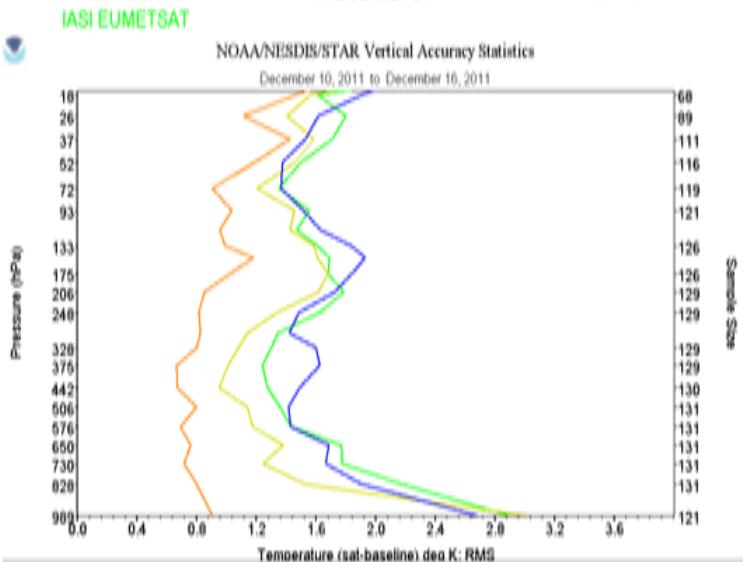
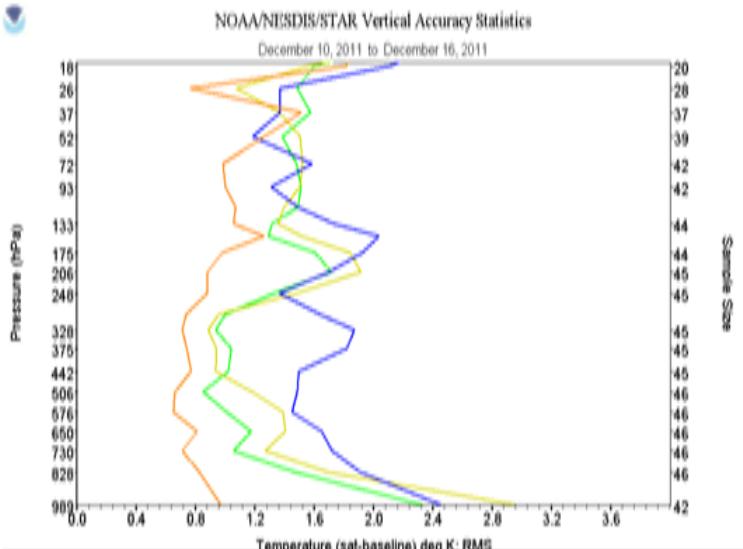
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+/- 3 hrs
50km
qc'd Sat
clear Sat
all terrain



+/- 3hrs
50km
EU not qc'd
clear Sat
all terrain



Common Sample



Common Sample Yield Analysis

System	None	QC	QC + Sea	QC + Clear
1 - ATOVS (MetOp)	.98	.95	.10	.61
2 – MIRS (MetOp)	.91	.97	.18	NA
3 - IASI NOAA	.80	.58 <i>(51)</i>	.10	.44
4 - IASI EU	.98	.32 <i>(10)</i>	.09	1.0
5 – COSMIC	.35	.97	NA	NA
6 – AIRS	.91	.74 <i>(66)</i>	.02	.29
7 – MIRS (SSMIS)	.73	.96	.18	NA

Table 6a: Sampling yield ratios for collocated sonde and respective satellite product systems (1-7) using no sampling constraints (None) and constraints of QC only, QC+Sea and QC+Clear for 30-day period during July, 2010.

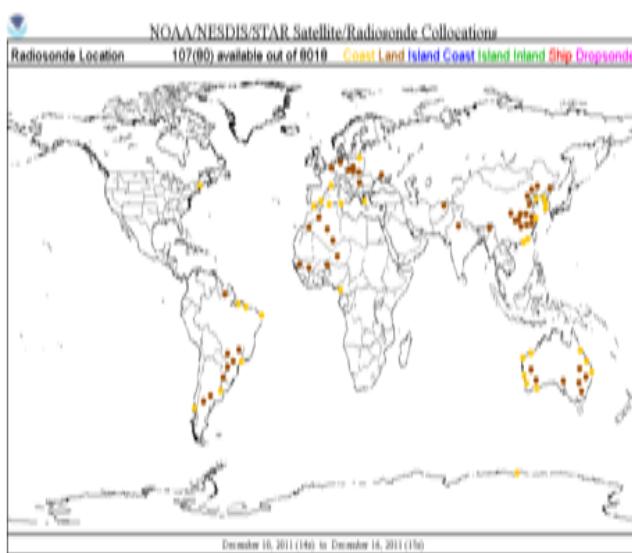
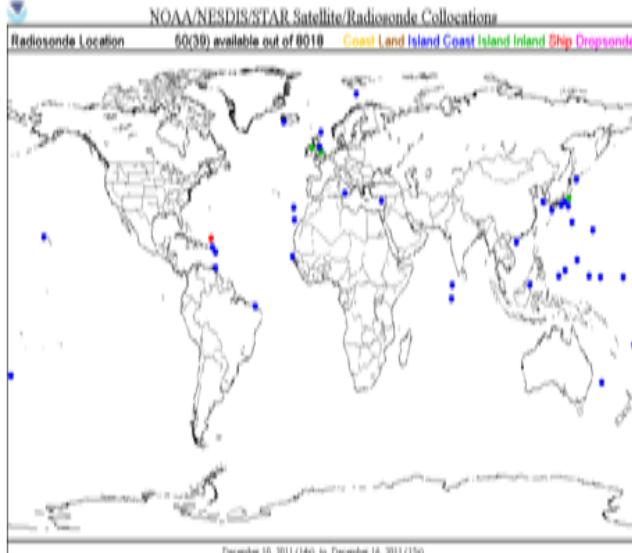
System	None	QC	QC + Sea	QC + Clear
1,2	.90	.94	.08	.62
3,4	.80	.25	.07	.67
1,2,3,	.76	.58	.07	.40
1,2,3,4	.76	.25	.05	.61
1,2,3,4,6,7	.51	.23	.02	.23
5,6,7	.26	.73	.02	.29
All *	.20	.22	.01	.28



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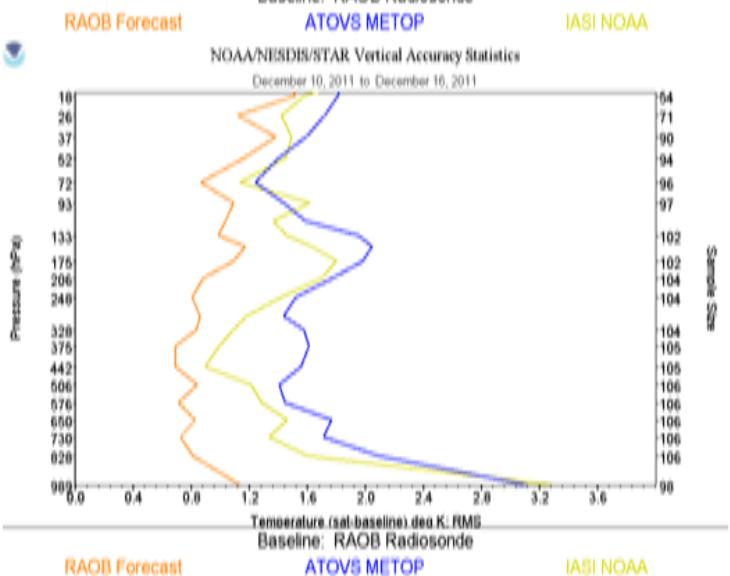
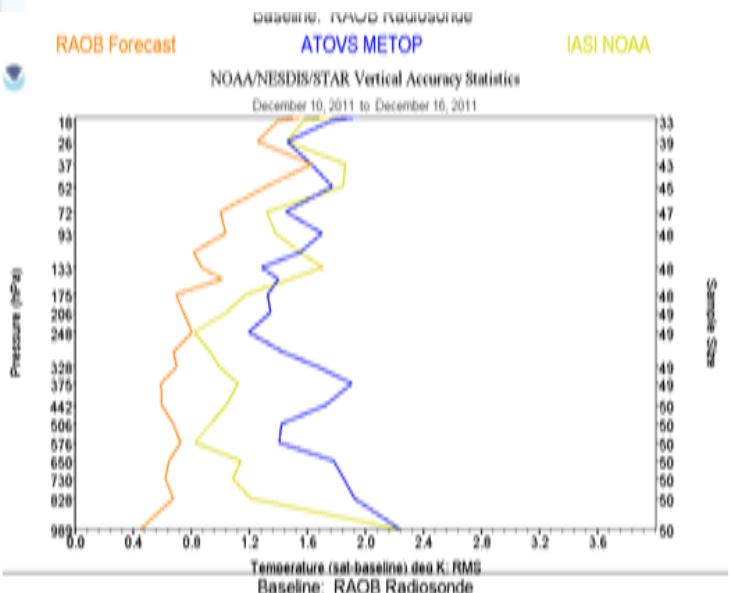
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+/- 3hr
50km
qc'd
clear
maritime Sonde

+/- 3hr
50km
qc'd
clear
non-maritime Sonde



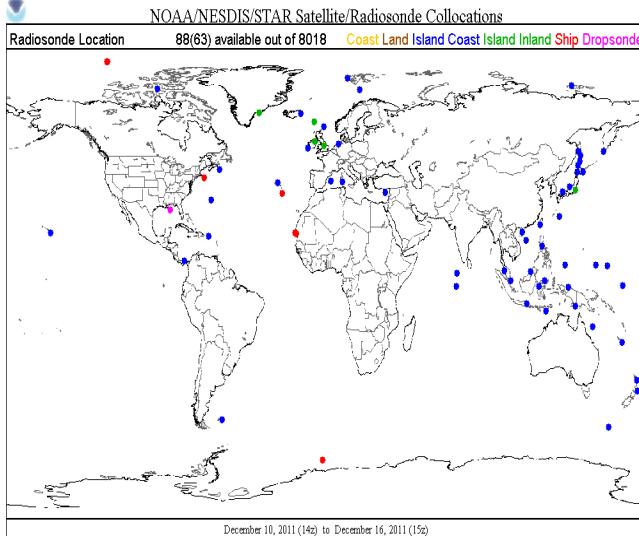
Common Sampling



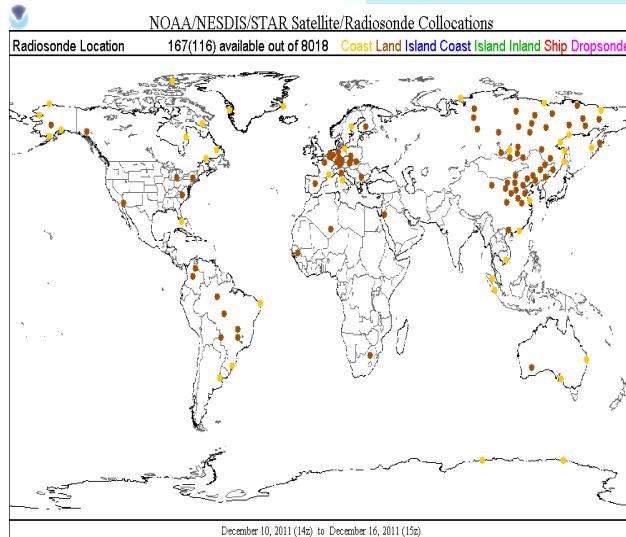
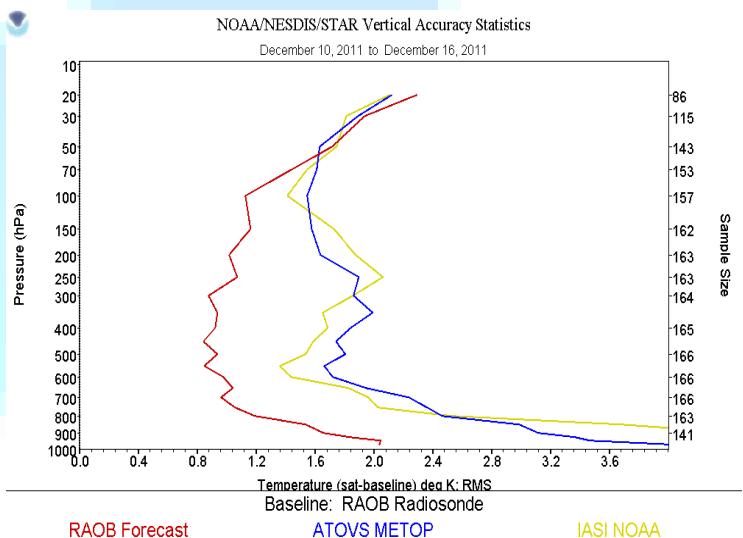
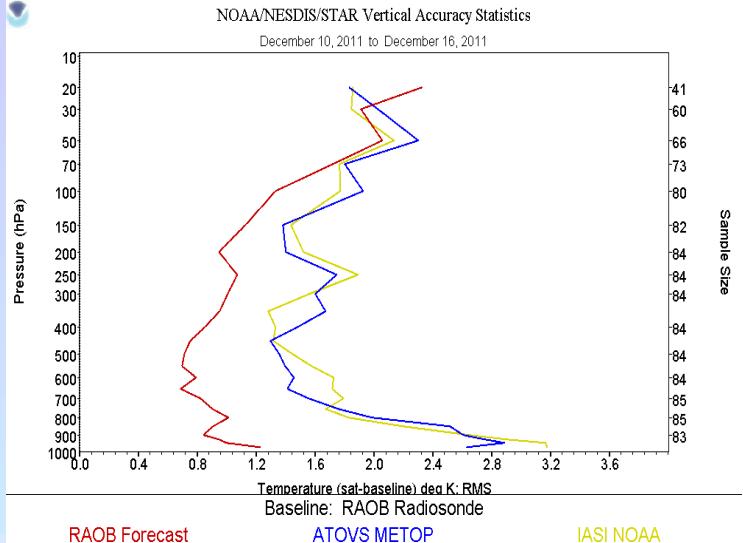
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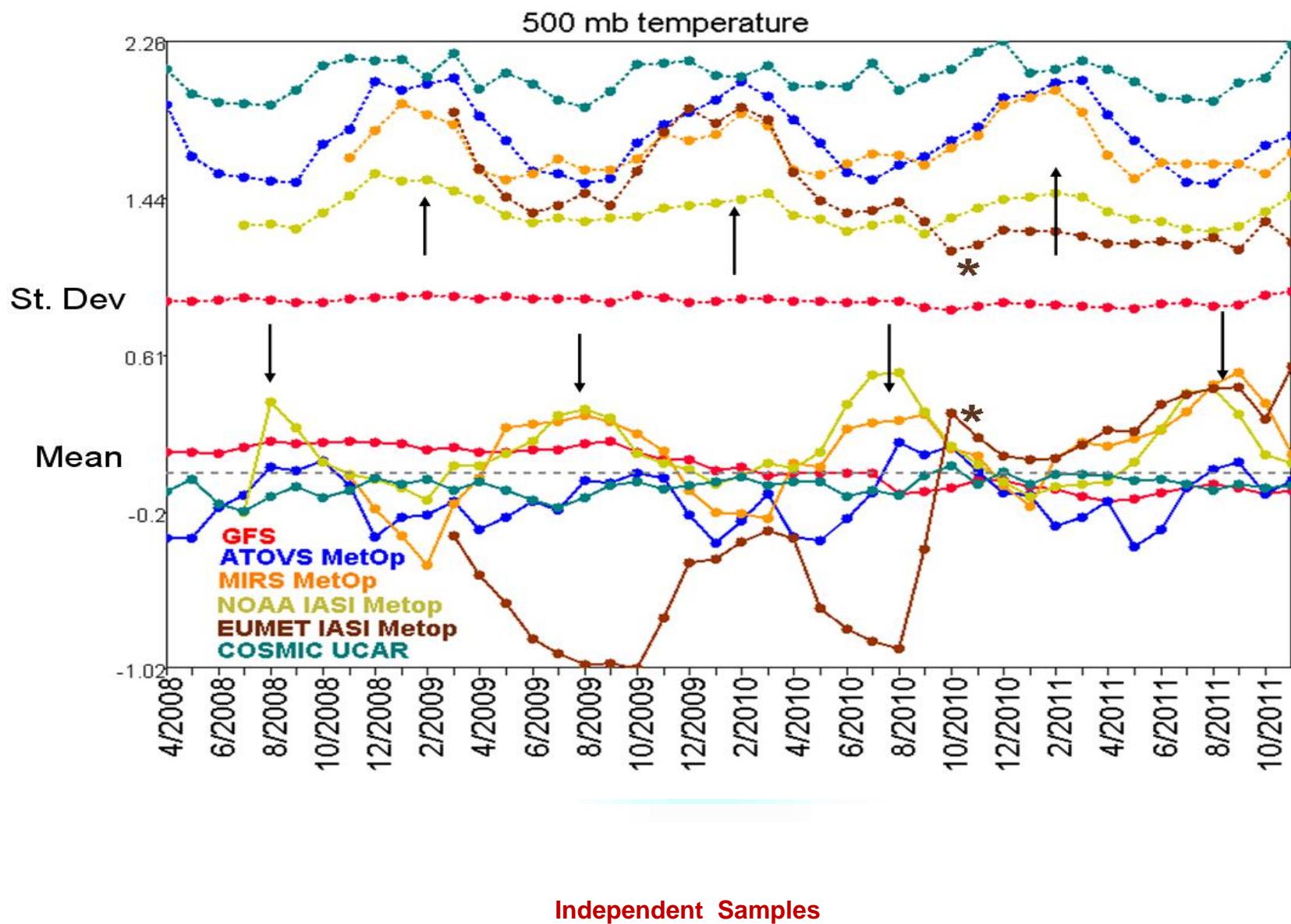


+/- 3hr
50km
qc'd
Cloudy
maritime



+/- 3hr
50km
qc'd
Cloudy
Non-maritime

Common Sampling





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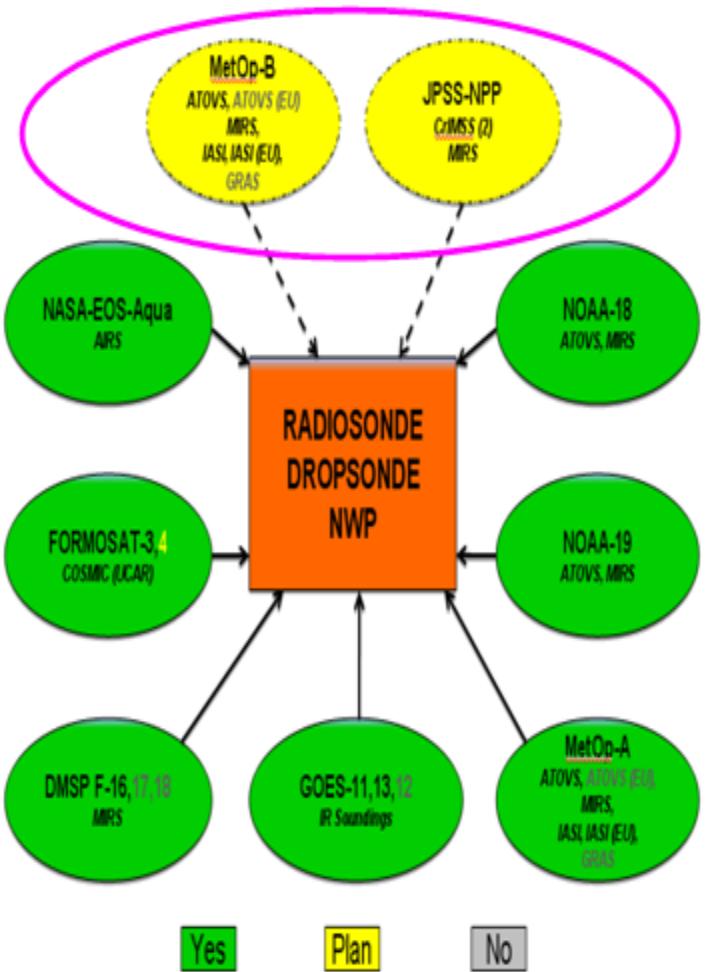


Bringing in NPP



- **Expansion for NPP**
 - IDPS, NUCAPS, MiRS ...
 - First guess, ATMS only ...

- **Issues**
 - 42 levels (IPDS) vs 100 levels (NUCAPS)
 - averaging strategy over 1km layers
 - Quality Control ... *new rules* !
 - Meeting spec (clear vs cloudy, T vs H₂O ...)





CriMSS Performance Specification

Atmospheric Vertical Temperature Profile (AVTP)

Measurement Uncertainty – Layer Average Temperature Error

PARAMETER	THRESHOLD
AVTP Clear, surface to 300 mb	1.6 K / 1-km layer
AVTP Clear, 300 to 30 mb	1.5 K / 3-km layer
AVTP Clear, 30 mb to 1 mb	1.5 K / 5-km layer
AVTP Clear, 1 mb to 0.5 mb	3.5 K / 5-km layer
AVTP Cloudy , surface to 700 mb	2.5 K / 1-km layer
AVTP Cloudy, 700 mb to 300 mb	1.5 K / 1-km layer
AVTP Cloudy, 300 mb to 30 mb	1.5 K / 3-km layer
AVTP Cloudy, 30 mb to 1 mb	1.5 K / 5-km layer
AVTP Cloudy, 1 mb to 0.5 mb	3.5 K/ 5-km layer

Atmospheric Vertical Moisture Profile (AVMP)

Measurement Uncertainty – 2-km Layer Average Mixing Ratio % Error

PARAMETER	THRESHOLD
AVMP Clear, surface to 600 mb	Greater of 20% or 0.2 g/kg / 2-km layer
AVMP Clear, 600 to 300 mb	Greater of 35% or 0.1 g/kg / 2-km layer
AVMP Clear, 300 to 100 mb	Greater of 35% or 0.1 g/kg / 2-km layer
AVMP Cloudy, surface to 600 mb	Greater of 20% of 0.2 g/kg / 2-km layer
AVMP Cloudy, 600 mb to 400 mb	Greater of 40% or 0.1 g/kg / 2-km layer
AVMP Cloudy, 400 mb to 100 mb	Greater of 40% or 0.1 g/kg / 2-km layer

(courtesy Nick Nalli)



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CrlMSS Validation Issues

- Levels: “42 (T), 22(MR)” vs 100 (T) 30 (MR)
 - IDPS vs NUCAPS
- Layers for validation (1km)
 - T vs (MR vs PW ...)
- Averaging of layers for meeting spec
 - T, MR (clear vs cloudy), (altitude)
 - Weighting (MR)
- Quality Flag ...
 - Can only reject precipitating scenes in IDPS



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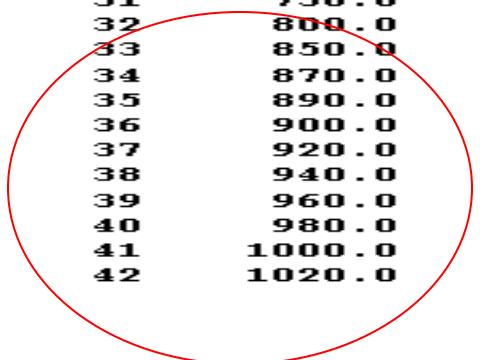
Pressures at P72 dataset

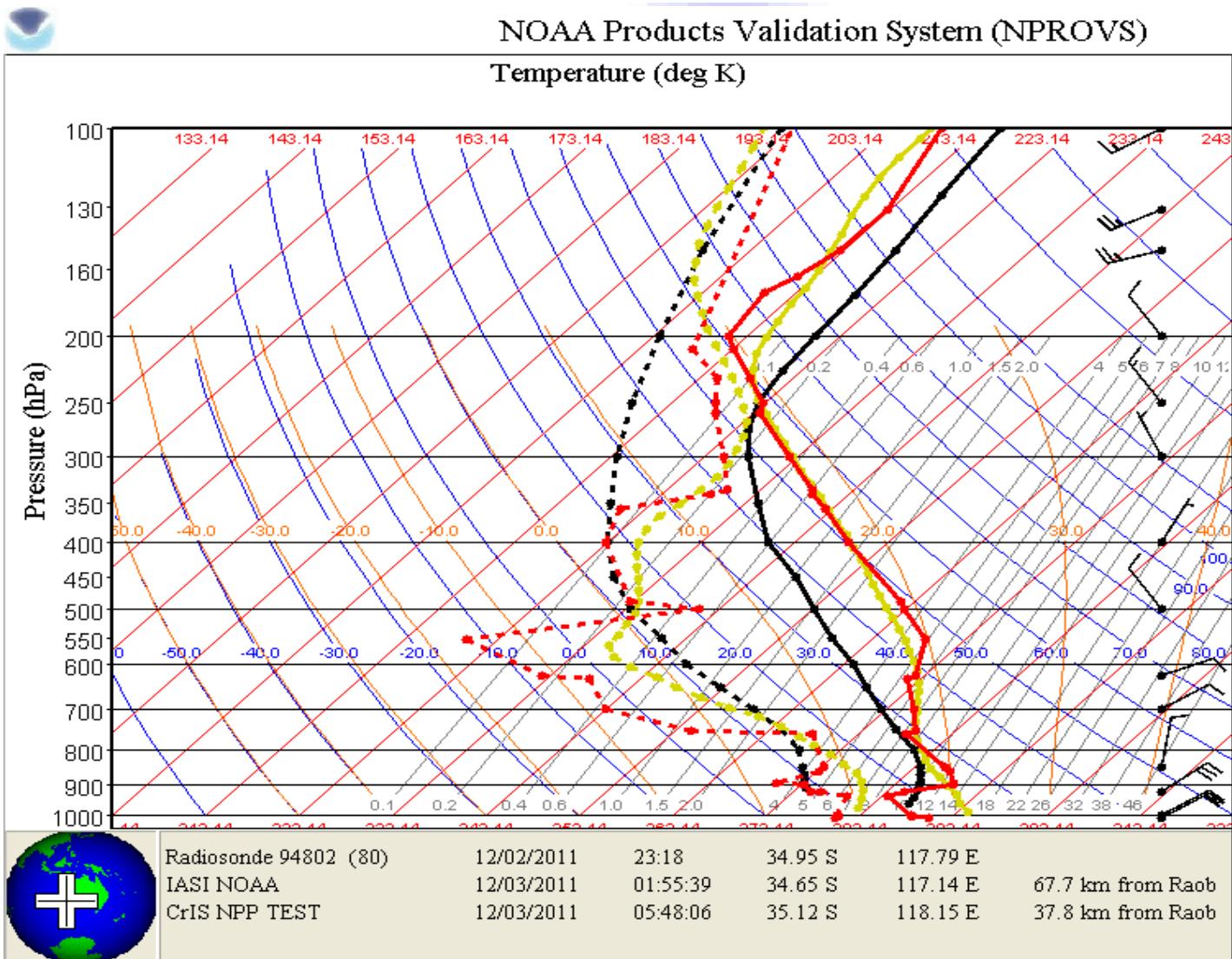
Temperature

1	.5
2	.7
3	.9
4	1.0
5	3.0
6	5.0
7	7.0
8	9.0
9	10.0
10	30.0
11	50.0
12	70.0
13	90.0
14	100.0
15	125.0
16	150.0
17	175.0
18	200.0
19	225.0
20	250.0
21	275.0
22	300.0
23	350.0
24	400.0
25	450.0
26	500.0
27	550.0
28	600.0
29	650.0
30	700.0
31	750.0
32	800.0
33	850.0
34	870.0
35	890.0
36	900.0
37	920.0
38	940.0
39	960.0
40	980.0
41	1000.0
42	1020.0

Water vapor

100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
550.0
600.0
650.0
700.0
750.0
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850.0
870.0
890.0
910.0
930.0
950.0
970.0

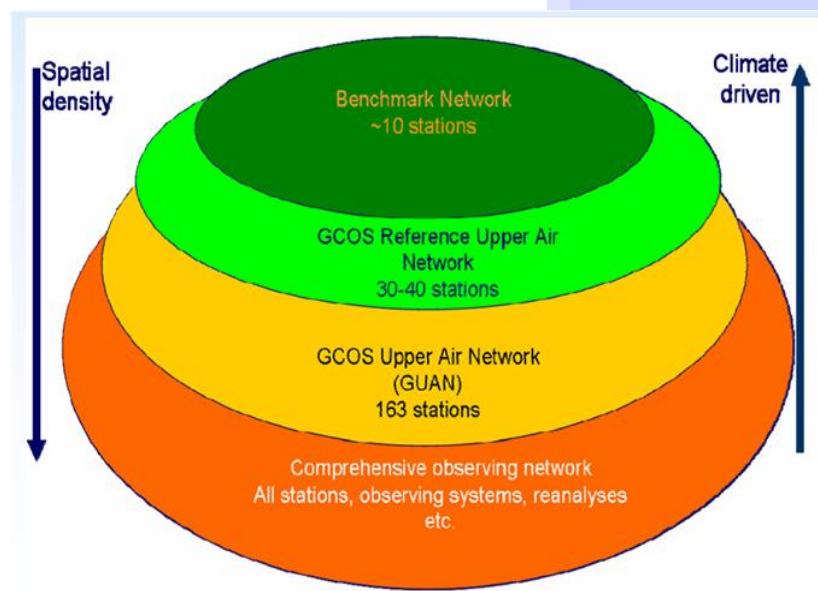




P72 Proxy CrIMSS moved to 12/03/11



NPROVS Facilitates NPP Validation within GCOS Reference Upper Air Network (GRUAN)



Initially 15 stations, envisaged to be a network of 30-40 sites across the globe



Fully characterize the site atmospheric column (sonde + ancillary)
at NPP overpass

- ARM site atmospheric state best estimate (SASBE) for AIRS temperature and water vapor retrieval validation ... *Tobin et al., 2006, J. Geophys. Res., 111, D09S14* ...
- Uncertainty analysis for estimating atmospheric temperature for remote sensing applications ... *Dykema et al., International Temperature Symposium, March 2012, Los Angeles, Ca.*
- *ICM-4 in Japan, March 2012*

Reference for Moisture

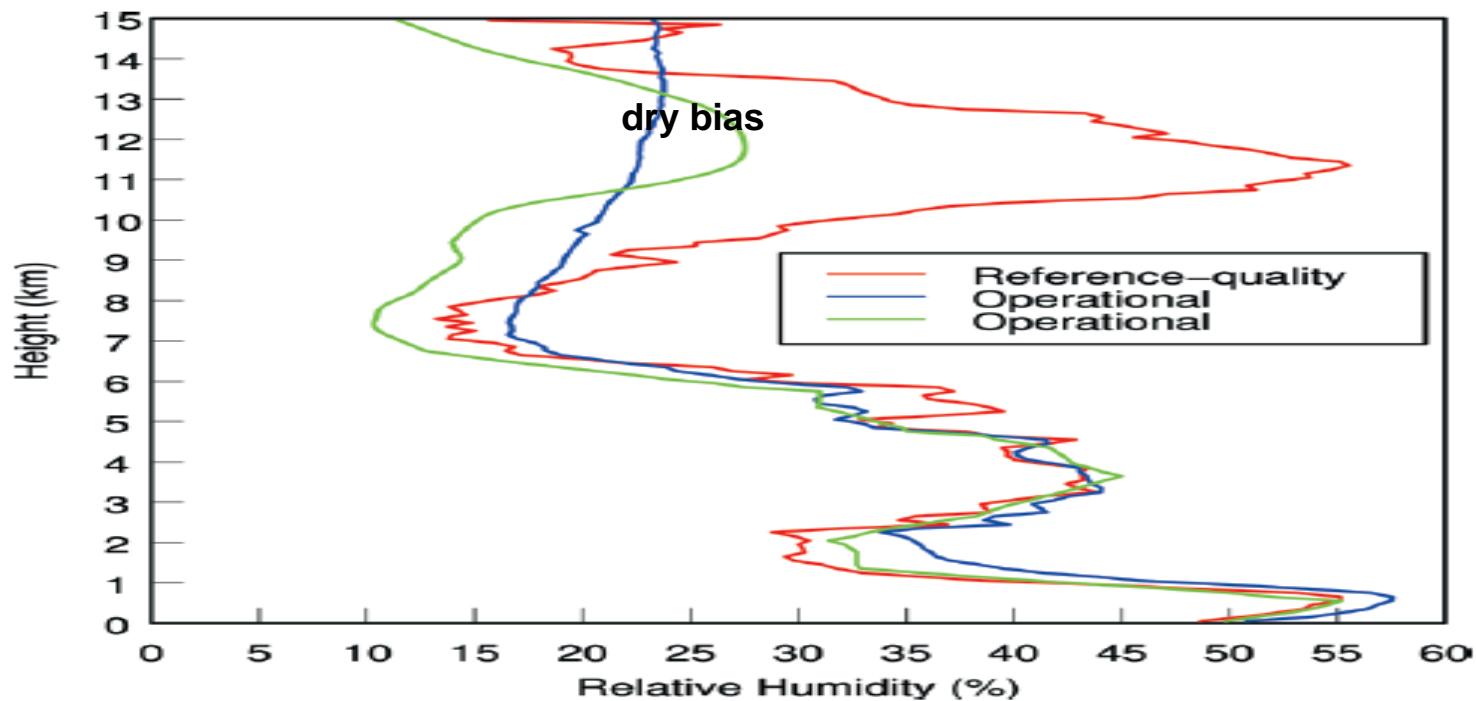


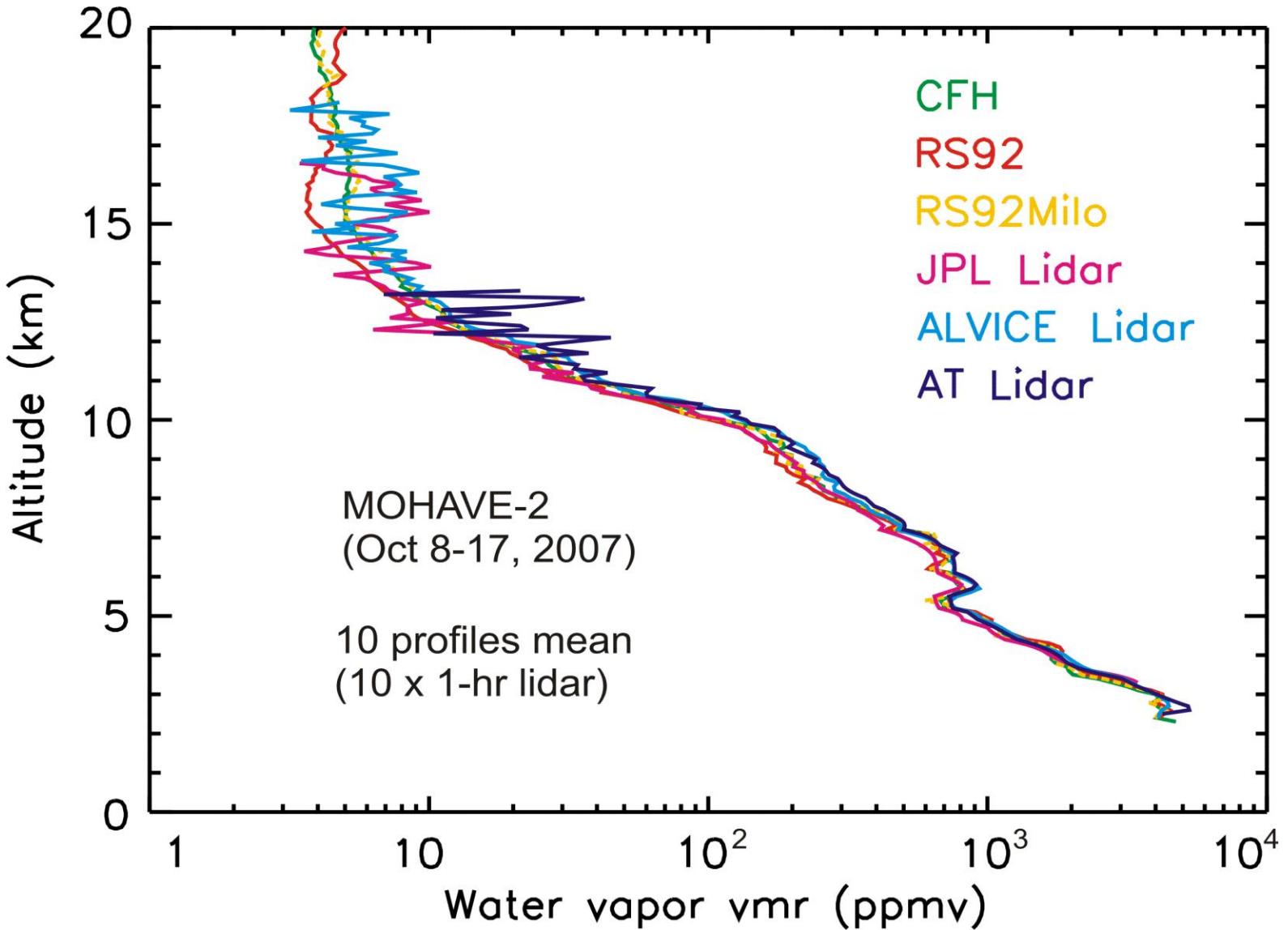
FIG. 5. Comparison of mean relative humidity profiles (averaged from six soundings at the Homestead research site, Oklahoma) measured by a reference-quality humidity sensor (Snow White, red curve) and by two types of operational humidity sensors (carbon hygristor, blue curve; Vaisala RS80-H, green curve). Note the dry bias in the operational sensors, particularly in the upper troposphere, and the lack of response of the hygristor at heights above 7 km. Adapted from Wang et al. (2003).

(courtesy Dian Seidel, NOAA Air Resources Lab)



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Courtesy Thierry LeBlanc (NASA)



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SUMMARY

- NPROVS will provide routine and specialized CrIMMS sounding product validation versus legacy satellite product systems and forecasts
- Terrain and Clouds have >1.0 increased RMS impact on perceived impacts using “qc’d” legacy IASI
- Provide a gateway to routine validation at emerging GCOS Reference Upper Air Network Sites